UNIVERSITI PUTRA MALAYSIA

COST CONTROL STRATEGIES FOR IBS CONTRACTORS IN MALAYSIA

LEW YOKE LIAN

COST CONTROL STRATEGIES FOR IBS CONTRACTORS IN MALAYSIA

By

LEW YOKE LIAN

Thesis Submitted to the School of Graduate Studies, Universiti Putra Malaysia, in Fulfilment of the Requirement for the Degree of Master of Science

August 2002

Abstract of thesis presented to the Senate of Universiti Putra Malaysia in fulfilment of the requirement for the degree of Master of Science

COST CONTROL STRATEGIES FOR IBS CONTRACTORS IN MALAYSIA

By

LEW YOKE LIAN

August 2002

Chairman: Salihudin Hassim, Ir.

Faculty: Faculty of Engineering

Industrialised Building System (IBS) is a system widely used in construction industry in Malaysia. This study is a survey to identify the factors contributing to cost control problems faced by local contractors in IBS projects and to identify the strategies used to reduce the cost variation in IBS projects. From the finding of the survey, a computer-based cost control model was developed to improve the effectiveness of cost control on IBS.

The survey shows that management team capability & performance, buildability of design, and timely decision making were the top-ranked factors contributing to cost control problems in IBS construction in Malaysia. Strategies like increase the working hours, increase manpower and/or equipment, provide close supervision to subordinates for minimising abortive work, and coordinate closely with subcontractors were identified as the most popular method used to reduce cost variation of IBS projects.

In hypotheses testing of this study, it was found that there is significant association between type of IBS used and the perceived contributor to cost control problems.

Results of Logistic Regression Analysis shows that allowance of partially handover, delay of payment from client to the contractor, deposit needed for IBS before delivery of the precast components, and application of tracking curve for cost control are likely to influence the cost variance of IBS construction projects.

The developed computer-based cost control model could assist constructor of IBS (with prefabricated elements) to plan their expenses and progress of work. Additionally, monitoring during the construction is made available through a series of user-friendly electronic forms. With identification of potential problem contributors, strategies to overcome cost variation, and application of the cost control model, cost control of IBS projects in Malaysia would be unproblematic to any new or existing IBS practitioners.

Abstrak tesis yang dikemukakan kepada Senate Universiti Putra Malaysia
sebagai memenuhi keperluan untuk ijazah Mastaer Sains

STRATEGI KAWALAN KOS UNTUK KONTRAKTOR IBS DI MALAYSIA

Oleh

LEW YOKE LIAN

Ogos 2002

Pengerusi: **Salihudin Hassim, Ir.**

Faculti: **Faculty of Engineering**

Industrialised Building System (IBS) merupakan satu sistem yang digunakan secara meluas di industri pembinaan di Malayisa. Projek ini adalah satu kajian untuk mengenalpasti faktor-faktor yang menyebabkan masalah kawalan kos semasa pembinaan dan juga strategi yang digunakan untuk mengatasi variasi kos yang terjadi. Daripada hasil kajian yang didapati, satu sistem kawalan kos berdasarkan komputer telahpun dihasilkan.

Daripada kajian yang dijalankan, keupayaan dan kecekapan kumpulan pengurusan, kebolehbinaan sesuatu rekabentuk dan kepantasan keputusan dibuat merupakan faktor utama yang menyebabkan masalah kawalan kos dalam pembinaan IBS di Malaysia. Peningkatan masa kerja, peningkatan tenaga buruh dan/atau peralatan, pengawalan yang lebih ketat kepada pekerja serta sub-kontraktor merupakan strategi yang paling kerap digunakan untuk mengurangkan variasi kos dalam projek pembinaan IBS.

Dalam pengujian hipotesis dalam kajian ini, jenis IBS yang digunakan didapati mempunyai perhubungan dengan faktor penyebab masalah kawalan kos. Keputusan

Regrasi Logistic pula menunjukkan kebenaran penyerahan mengikut bahagian, kelambatan pembayaran daripada pelanggan, keperluan pembayaran wang pendahuluan oleh pembekal IBS dan penggunaan *tracking curve* akan mempengaruhi variasi kos projek pembinaan IBS.

Sistem kawalan kos yang dihasilkan akan dapat membantu pembina IBS (yang menggunakan elemen pasang-siap) untuk merancang perbelanjaan dan kemajuan kerja. Tambahan pula, pengawalan semasa pembinaan boleh dilakukan melalui borang kawalan dalam komputer. Dengan pengenalpastian penyebab masalah, stategi untuk mengatasi variasi kos dan penggunaan sistem kawalan kos, kawalan kos projek IBS di Malaysia akan menjadi lebih mudah.

ACKNOWLEDGEMENT

I would like to express my deepest and sincere appreciation to my supervisor, Ir. Salihudin Hassim for his invaluable advise, guidance, suggestions and unfailing help throughout the project. My sincere thanks are also extended to the chairman of the VIVA examination, Prof. D. N. Trikha; my examiners, Prof. Madya Ir. Dr. Mohd. Razali Abdul Kadir and Mr. Law Teik Hwa for their comments and suggestions in this project.

Besides, I would like to thanks to all practitioners of IBS that have shared their invaluable experience and knowledge. Last but not least, I would like to express my gratitude to the senior students and friends who have helped me during this project.

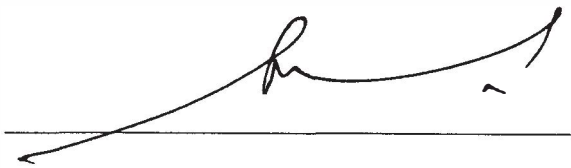
I certify that an Examination Committee met on 12th August 2002 to conduct the final examination of Lew Yoke Lian on her Master of Science thesis entitled "Cost Control Strategies for IBS Contractors in Malaysia" in accordance with Universiti Pertanian Malaysia (Higher Degree) Act 1980 and Universiti Pertanian Malaysia (Higher Degree) Regulations 1981. The Committee recommends that tha candidate be awarded the relevant degree. Members of the Examination Committee are as follows:

D.N. TRIKHA, Ph.D.
Professor
Faculty of Engineering
Universiti Putra Malaysia
(Chairman)

SALIHUDIN BIN HASSIM, Ir.
Faculty of Engineering
Universiti Putra Malaysia
(Member)

MOHD. RAZALI BIN ABDUL KADIR, Ph.D., Ir.
Assoc. Professor/Deputy Dean (Development)
Faculty of Engineering
Universiti Putra Malaysia
(Member)

LAW TEIK HUA
Faculty of Engineering
Universiti Putra Malaysia
(Member)



SHAMSHER MOHAMAD RAMADILI, Ph.D.
Professor/ Deputy Dean
School of Graduate Studies
Universiti Putra Malaysia

Date: 23 NOV 2002

This thesis submitted to the Senate of Universiti Putra Malaysia has been accepted as fulfilment of the requirement for the degree of Master Science. The members of the Supervisory Committee are as follows:

SALIHUDIN BIN HASSIM, Ir.
Faculty of Engineering
Universiti Putra Malaysia
(Chairman)

MOHD. RAZALI BIN ABDUL KADIR, Ph.D., Ir.
Assoc. Professor/Deputy Dean (Development)
Faculty of Engineering
Universiti Putra Malaysia
(Member)

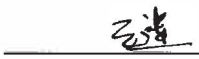
LAW TEIK HUA
Faculty of Engineering
Universiti Putra Malaysia
(Member)

AINI IDERIS, Ph.D.
Professor/Dean
School of Graduate Studies
Universiti Putra Malaysia

Date: 9 JAN 2003

DECLARATION

I hereby declare that the thesis is based on my original work except for quotations and citations which have been duly acknowledged. I also declare that it has not been previously or concurrently submitted for any other degree at UPM or other institutions.



LEW YOKE LIAN

Date: 3rd Oct 2002

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

NOTATIONS

IBS	Industrialised Building System
WBS	Work Breakdown Structure
CBS	Cost Breakdown Structure

CHAPTER 1

INTRODUCTION

Between years 1995 to 2020, Malaysia will need a total of 8,850,554 houses, including 4,964,560 units of new housing to cater for the increase in population during this period. Unfortunately, only 1,382,917 units were constructed under the 6th (1991-1995) and 7th (1996-2000) Malaysia Plan. We have another 3,581,643 units to be built within the next twenty years. That is on average 1,790,820 units to be built for every ten years. It is clear that unless a drastic change of policy pertaining to population growth is adopted, or some new solutions for this increase in housing demand is implemented, the housing problem is expected to continue for years to come (Chen, 2000).

Industrialised Building System (IBS) has been proposed in many writings as the solution for this increasing housing demands (Koo, 2000; Omar, 2000; Engletrik, 2000; Trikha, 1999; Karim and Adeeb, 1993; Din, 1984). Chew (1986) from Ministry of Housing and Local Government, Malaysia mentioned that shorter construction time, saving in labour cost/dependency, material saving, better quality control, immunity to weather changes and the cost factor are among the advantages of IBS. Shorter construction time offered by IBS seems to be the panacea for the housing demand in Malaysia and it is proven successful in some of the countries, namely Finland, England, and United States (CIDB, 1998).

From the records in PAM's publications, different types of IBS have been used in Malaysia since mid-50s and it is still expanding (Loo, 1986). Though some

of the IBS projects were successful in sustaining lower costs, others ended up with higher costs in comparison to similar conventional housing projects. (Din, 1986)

Survey done by Malaysian Institute of Architects (PAM) on Industrialised System for Housing in year 1986 (Loo, 1986) shows that in order to strengthen the weaknesses for its improvements, it is essential to examine each activity from the total delivery cycle of construction work in order to diagnose the real weaknesses.

In the background of early 80's the prefabrication method would cost more due to their destitution of experience. However, the logic of the day was to set-off the benefits of faster completion time against the higher unit cost in view of the escalating prices due to the inflationary trend and that early delivery would save the buyers interest charges and rentals. Cost overrun in the IBS projects are still common in Malaysia until today and it is one of the reasons that limit the development of IBS (Lew, 2000). In a research done in year 2000, 60% of the projects studied experience delay of progress. The survey shows that more than half of the projects studied have experienced cost overrun and material is the cost element that contributes most of the variances (Lew *et. al.*, 2000). Importance of cost-consciousness during construction is still not widespread in local construction projects. Cost control for IBS is conducted as part of cost control of whole construction project. In most of the cases, IBS works are awarded to suppliers or subcontractors that specialized in IBS where monitoring of cost control over IBS works has been overlooked (Lew *et. al.*, 2000).

According to Flanagan and Tate (1997), the aim of cost control on construction is to achieve faster construction to a higher quality at a lower cost. A project may be regarded as 'successful' if the building is completed on time, within budget, without any accident, to the specified quality standards and overall clients' satisfaction (Chan and Kumaraswamy, 2002). Kharbanda *et. al.* (1987) mentioned that the basic concepts of cost control are nothing new due to the size and complexity of modern projects and the risks thereby involved, cost control today is more vital, and more necessary than ever before. Therefore, cost control for local IBS projects will be just applying the same old concepts of cost control with more emphasis given on the differences between IBS and conventional construction methods, local site conditions and availability of information or data needed in doing so.

Problem Statement

There are at least fourteen IBS being introduced in Malaysia (Thanoon *et al.*, 1996) for years, each of them have their own characteristics which are different from conventional construction method. Therefore, management of IBS projects could not be exactly the same as what we implement for conventional construction method.

Even though a number of cost control systems have been introduced for construction projects, there is neither one which is specifically developed for the construction projects using industrialised building system in Malaysia. According to Dawood (1994), most of the researches in the precast industry are concentrated on the application of mathematical models to scheduling and long-range planning. Even though there are models developed to calculate cost variance, it is not meant for IBS industry and it is certainly not for Malaysia's working environment. Many potential users of IBS in Malaysia currently have no formal cost control system to monitor their construction costs. We do have the traditional methods or systems of cost control from centuries of trials, yet, we are still seeking for practicable cost control system for IBS.

Generally, IBS are used in large projects with repetitive units and these projects are extremely likely to have major overruns on both time and budget (Hardie, 2001). Therefore, identification of potential problems and development of a cost control model would absolutely assist in prevention and minimization of negative cost variance occurrence.

Significant of Study

Due to the current economic downturn, construction project cost control become a great subject to all the practitioners in construction industry. Effective construction systems that can maximize the profit determine the success of construction companies. In conjunction with this, new systems have been introduced to reduce the cost and improve the quality of work.

Industrialised Building System is one of the new methods introduced for these purposes. These new building systems introduced are new methods of construction that use new or modified materials and new technology. They are said to be more effective in reducing manpower demand, duration of construction and cost needed. Nevertheless, the degree of these systems' effectiveness are being queried, can these systems really helps in reducing projects' cost by achieving the advantages afore-mentioned? Or it is just a new idea of businessmen trying to increase their profit? How do the project and other related characteristics that affect the cost variance of these systems' construction affect their efficiency?

By identifying obstacles afore-mentioned, a cost control model will be proposed based on the local working environments. This is extremely important towards better cost control of IBS projects especially for contractors with limited works in hand, higher competition and small margin on the profit from each project during this recession time.

Objectives

This study is carried out to examine the factors contributing to problems faced by local contractors that are related to the cost management of IBS projects in Malaysia. The dominant objectives of this study are as follow:

1. To identify the factors contributing to problems faced by local contractors to control cost of IBS projects during construction.

2. To identify the strategies used by local contractors to reduce the cost variation in IBS projects.

3. To propose a tentative cost control model for IBS projects.

The hypotheses that need to be tested in this study,

1. There is no relationship in problems faced by the local contractors during construction of different building systems.

For first objective, the following hypotheses need to be tested:

2. Academic qualification of respondent is likely to influence the cost variance of IBS projects.
3. Respondent's experience in IBS is likely to influence the cost variance of IBS projects.

4. Project's nature of work is likely to influence the cost variance of IBS projects.

5. Type of client is likely to influence the cost variance of IBS projects.

6. Location of project is likely to influence the cost variance of IBS projects.

7. Type of contract is likely to influence the cost variance of IBS projects.

8. Allowance of partially handover is likely to influence the cost variance of IBS projects.

9. Delayed payment from client is likely to influence the cost variance of IBS projects.

10. Frequency of meeting with client is likely to influence the cost variance of IBS projects.

11. Type of IBS is likely to influence the cost variance of IBS projects.

12. Construction method is likely to influence the cost variance of IBS projects.

13. Frequency of meeting with supplier/subcontractor is likely to influence the cost variance of IBS projects.

14. Time lag of IBS elements' delivery is likely to influence the cost variance of IBS projects.

15. On site prefabrication is likely to influence the cost variance of IBS projects.

16. Requirement of deposit by the supplier before the first delivery is likely to influence the cost variance of IBS projects.

17. Number of variation order is likely to influence the cost variance of IBS projects.

18. Application of cost control method is likely to influence the cost variance of IBS projects.